

CLAIMS

What is claimed is:

1 1. A method for identifying a bitloading assignment for a multicarrier
2 communication channel having a number of sub-channels, a maximum capacity
3 assignment, and a disposable bit capacity of one or more bits, the method comprising:
4 identifying a sub-channel having a maximum bit loading relative to bit
5 loadings of other sub-channels;
6 decrementing the bit loading of the identified sub-channel by at least one bit
7 thereby reducing bit loading differences between the identified sub-
8 channel and the other sub-channels;
9 decrementing the disposable bit capacity by the number of bits the identified
10 sub-channel loading was decremented; and
11 repeating the identifying step and the decrementing steps until a desired degree
12 of equalization between the sub-channel bit loadings is achieved
13 thereby producing a bitloading assignment for the multicarrier
14 communication channel.

1 2. The method of claim 1, wherein the steps are carried out by a set of codes
2 or instructions executed by a processor included in a transceiver of the multicarrier
3 communication system.

1 3. The method of claim 1, wherein in response to a number of sub-channels
2 having the same maximum bit loading, the identifying step further includes:
3 selecting one of the sub-channels having the same maximum bit loading based
4 on a predefined selection scheme.

1 4. The method of claim 1, wherein the number of bits by which the identified
2 sub-channel loading is decremented depends on at least one of the number of sub-
3 channels of the multicarrier communication channel, the disposable bit capacity of the

4 multicarrier communication channel, and a bitmap associated with the multicarrier
5 communication channel.

1 5. The method of claim 1, further comprising:

2 transmitting the bitloading assignment to a remote transceiver operatively
3 coupled to the multicarrier communication channel thereby allowing
4 the remote transceiver to use the bitloading assignment in performing
5 bitloading.

1 6. The method of claim 1, wherein the desired degree of equalization
2 between the sub-channel bit loadings is achieved when the disposable bit capacity is zero.

1 7. The method of claim 1, wherein the bitloading assignment produced by
2 the method desensitizes the multicarrier communication channel to non-stationary noise.

1 8. The method of claim 1, wherein the multicarrier communication channel
2 is realized with an ADSL Annex C transceiver pair coupled to one another via a
3 transmission line.

1 9. The method of claim 1, wherein the multicarrier communication channel
2 is effectively two different channels, one being a FEXT time channel and the other being
3 a NEXT time channel, each effective channel having a unique maximum capacity
4 assignment upon which the method operates thereby producing a first bitloading
5 assignment for the FEXT channel and a second bitloading assignment for the NEXT
6 channel.

1 10. The method of claim 1, wherein the maximum capacity assignment of the
2 multicarrier communication channel is derived from a bitmap prepared during a
3 bitloading training session.

1 11. The method of claim 1, wherein the maximum capacity assignment of the
2 multicarrier communication channel is in the form of a bit vector upon which the method
3 operates.

1 12. A method for identifying a bitloading assignment for a multicarrier
2 communication channel having a number of sub-channels, the method comprising:
3 calculating a maximum number of bits that can be transmitted by each sub-
4 channel;
5 rounding the maximum number of bits that can be transmitted by each sub-
6 channel to the nearest whole bit;
7 calculating the maximum number of bits that can be transmitted by the
8 multicarrier communication channel based on the rounded maximum
9 number of bits that can be transmitted by each sub-channel;
10 determining a target load of the multicarrier communication channel thereby
11 defining a disposable bit capacity representing a delta value between
12 the maximum number of bits that can be transmitted by the multicarrier
13 communication channel and the target load of the multicarrier
14 communication channel;
15 identifying a maximum loaded sub-channel;
16 decrementing the maximum loaded sub-channel by at least one bit;
17 decrementing the delta value; and
18 repeating the identifying step and the decrementing steps until the delta value
19 is zero thereby producing a bitloading assignment that desensitizes the
20 multicarrier communication channel to non-stationary noise.

1 13. The method of claim 12, wherein the maximum number of bits that can be
2 transmitted by each sub-channel, and the maximum number of bits that can be
3 transmitted by the multicarrier communication channel are derived from a bitmap
4 resulting from a bitloading training sequence, the bitmap characterizing the signal to
5 noise ratio of the multicarrier communication channel.

1 14. The method of claim 12, wherein the target load of the multicarrier
2 communication channel is based on system configuration options.

1 15. The method of claim 12, wherein the multicarrier communication channel
2 is realized using digital multi-tone modulation.

1 16. The method of claim 12, wherein in response to identifying more than one
2 maximum loaded sub-channel thereby requiring a selection to be made, the method
3 further includes:

4 calculating a round off error for each sub-channel; and

5 selecting the maximum loaded sub-channel having the greatest round off error.

1 17. The method of claim 12, wherein in response to identifying more than one
2 maximum loaded sub-channel thereby requiring a selection to be made, the method
3 further includes:

4 selecting the maximum loaded sub-channel based on a predefined selection
5 scheme.

1 18. A transceiver for identifying a bitloading assignment for a multicarrier
2 communication channel having a number of sub-channels and a disposable bit capacity of
3 one or more bits, the transceiver comprising:

4 a bitloading assignment module for equalizing bit loadings of the sub-channels
5 by selectively decrementing high bitload sub-channels until the
6 disposable bit capacity is zero thereby producing a bitloading
7 assignment for the multicarrier communication channel.

1 19. The transceiver of claim 18, further comprising:

2 a symbol decision and symbol-to-bit decoder module operatively coupled to
3 the bitloading assignment module and for deriving a maximum capacity
4 assignment from a bitmap that characterizes the multicarrier
5 communication channel.

1 20. The transceiver of claim 18, wherein the high bitload sub-channels are
2 decremented by a number of bits depending on at least one of the number of sub-channels
3 of the multicarrier communication channel, the disposable bit capacity of the multicarrier

4 communication channel, and a bitmap associated with the multicarrier communication
5 channel.

1 21. The transceiver of claim 18, wherein the high bitload sub-channels are
2 decremented one bit at a time.

1 22. The transceiver of claim 18, wherein the disposable bit capacity cannot be
2 below zero as a result of decrementing high bitload sub-channels.

1 23. The transceiver of claim 18, wherein the bitloading assignment is
2 enhanced in that it desensitizes the multicarrier communication channel to non-stationary
3 noise.

1 24. The transceiver of claim 18, wherein the multicarrier communication
2 channel is effectively two different channels, one being a FEXT time channel and the
3 other being a NEXT time channel, each effective channel having a unique maximum
4 capacity assignment upon which the bitloading assignment module operates thereby
5 producing a first bitloading assignment for the FEXT channel and a second bitloading
6 assignment for the NEXT channel.

1 25. The transceiver of claim 18, wherein the bitloading assignment is in the
2 form of a bit vector upon which the bitloading assignment module operates.

1 26. The transceiver of claim 18, wherein the bitloading assignment module
2 selects a high bitload sub-channel for decrementing based on a predefined selection
3 scheme.

1 27. A method for identifying a bitloading assignment for an ADSL Annex C
2 multicarrier communication channel having a number of sub-channels, a maximum
3 capacity assignment, and a disposable bit capacity of one or more bits, the method
4 comprising:

5 identifying a sub-channel having a maximum bit loading relative to bit
6 loadings of other sub-channels;

7 decrementing the bit loading of the identified sub-channel by at least one bit
8 thereby reducing bit loading differences between the identified sub-
9 channel and the other sub-channels;
10 decrementing the disposable bit capacity by the number of bits the identified
11 sub-channel loading was decremented; and
12 repeating the identifying step and the decrementing steps until the disposable
13 bit capacity is zero thereby producing a bitloading assignment that
14 desensitizes the ADSL Annex C multicarrier communication channel to
15 non-stationary noise.

1 28. A method for identifying a bitloading assignment for an ADSL Annex C
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an
3 overall target bit capacity, the method comprising:

4 equalizing bits allocated to the FEXT channel and the NEXT channel until the
5 overall target bit capacity is achieved thereby identifying a target bit
6 capacity for the FEXT channel and a target bit capacity for the NEXT
7 channel;

8 equalizing bits allocated to sub-channels included in the FEXT channel by:

9 identifying a sub-channel having a maximum bit loading relative to bit
10 loadings of other sub-channels of the FEXT channel;

11 decrementing the bit loading of the identified sub-channel by at least
12 one bit thereby reducing bit loading differences between the
13 identified sub-channel and the other sub-channels; and

14 repeating the identifying step and the decrementing steps until the
15 target bit capacity for the FEXT channel is achieved thereby
16 producing a bitloading assignment that desensitizes the FEXT
17 channel to non-stationary noise;

18 equalizing bits allocated to sub-channels included in the NEXT channel by:

19 identifying a sub-channel having a maximum bit loading relative to bit
20 loadings of other sub-channels of the NEXT channel;

21 decrementing the bit loading of the identified sub-channel by at least
22 one bit thereby reducing bit loading differences between the
23 identified sub-channel and the other sub-channels; and
24 repeating the identifying step and the decrementing steps until the
25 target bit capacity for the NEXT channel is achieved thereby
26 producing a bitloading assignment that desensitizes the NEXT
27 channel to non-stationary noise.

1 29. A transceiver for identifying a bitloading assignment for an ADSL Annex
2 C multicarrier communication channel having a FEXT channel, a NEXT channel, and an
3 overall target bit capacity, the transceiver comprising:

4 a bitloading assignment module adapted to equalize bits allocated to the FEXT
5 channel and the NEXT channel until the overall target bit capacity is
6 achieved thereby identifying a target bit capacity for the FEXT channel
7 and a target bit capacity for the NEXT channel, and the bitloading
8 assignment module further adapted to equalize bits allocated to sub-
9 channels included in the FEXT channel until the target bit capacity for
10 the FEXT channel is achieved thereby producing a bitloading
11 assignment that desensitizes the FEXT channel to non-stationary noise,
12 and the bitloading assignment module further adapted to equalize bits
13 allocated to sub-channels included in the NEXT channel until the target
14 bit capacity for the NEXT channel is achieved thereby producing a
15 bitloading assignment that desensitizes the NEXT channel to non-
16 stationary noise.

1 30. A method for identifying a bitloading assignment for an ADSL Annex C
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an
3 overall target bit capacity, the method comprising:

4 equalizing bits allocated to the FEXT channel and the NEXT channel until the
5 overall target bit capacity is achieved thereby identifying a target bit
6 capacity for the FEXT channel and a target bit capacity for the NEXT
7 channel.

1 31. A method for identifying a bitloading assignment for an ADSL Annex C
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an
3 overall target bit capacity, the method comprising:

4 allocating bits between the FEXT channel and the NEXT channel until the
5 overall target bit capacity is achieved thereby identifying a target bit
6 capacity for the FEXT channel and a target bit capacity for the NEXT
7 channel.